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ASSIGNMENT BOOKLET

SCN2261 Physics 20

Module 3 Assignment

FOR STUDENT USE ONLY

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Assignment

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
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Physics 20

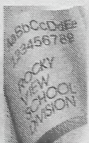
Learn  veryWare


 educate

Module 3

EFFECTS OF FORCE ON VELOCITY

ASSIGNMENT BOOKLET



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Summary

	Total Possible Marks	Your Mark
Lesson 1 Assignment	29	
Lesson 2 Assignment	31	
Lesson 3 Assignment	20	
Lesson 4 Assignment	21	
Lesson 5 Assignment	34	

Teacher's Comments

Physics 20
Module 3: Effects of Force on Velocity
Assignment Booklet
ISBN 978-0-7741-3009-7

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Teachers	✓
Administrators	
Home Instructors	
General Public	
Other	



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MODULE 3: LESSON 1 ASSIGNMENT

This Module 3: Lesson 1 Assignment is worth 29 marks. The value of each assignment and each question is stated in the left margin.

(29 Marks) Lesson 1 Assignment: Newton's First and Second Laws of Motion

(3 marks) LAB 1. Write a hypothesis. Follow the directions under the subheading "Hypothesis" on page 144 of your textbook.

(7 marks) LAB 2. Complete all the steps of "Procedure." Then answer questions 1, 2, 3, 4, and 5 of the "Analysis." You will create copies of "Table 3.2" and "Table 3.3" on page 145 and submit the tables with your recorded data to your teacher.

(8 marks) LAB 3. Answer questions 7, 8, 9, and 10 of “Analysis” on page 145 of your textbook.

(1 marks) LAB 4. Complete the step outlined in the first bullet, and write a hypothesis. Use the words *if* and *then*.

(2 marks) LAB 5. Complete the steps outlined in the third bullet. You will create two graphs. You may submit these graphs on a separate piece of paper.

- (2 mark) **LAB 6.** Complete the steps outlined in the fourth bullet. You will analyze the data and compare it to your hypothesis.
- (2 marks) **TR 3.** If a vehicle is involved in a collision that produces a -1500 N net force, what is the acceleration of a 75.5-kg passenger in the car?
- (2 marks) **TR 4.** If an unbalanced force of $+55.2 \text{ N}$ causes a hockey puck to accelerate across some ice with an acceleration of $+100 \text{ m/s}^2$, what is the puck's mass?
- (2 marks) **TR 5.** A plane with a mass of $4.50 \times 10^3 \text{ kg}$ accelerates on takeoff at 10.0 m/s^2 . What is the net force acting on the plane?
- (2 marks) **TR 6.** A car can accelerate at 18.0 m/s^2 and has a mass of 3500 kg . A motorcycle engine can produce 9000 N of force at maximum power output. If the motorcycle has a mass of 565 kg , can it accelerate faster than the car?

MODULE 3: LESSON 2 ASSIGNMENT

This Module 3: Lesson 2 Assignment is worth 31 marks. The value of each assignment and each question is stated in the left margin.

(31 Marks) Lesson 2 Assignment: Newton's Third Law

- (5 marks) **LAB 1.** Record the information from the following chart, and complete the calculations for skater 2. (The calculations for skater 1 have been done for you as examples.) Let motion to the right be positive and motion to the left be negative.

Skater 1	Skater 2
initial velocity = 0.00 m/s	initial velocity = 0.00 m/s
final velocity = -0.23 m/s	final velocity = _____
change in velocity = -0.23 m/s	change in velocity = _____
time interval over which the force is applied = 0.10 s *Note: This is not displayed on the simulation.	time interval over which the force is applied = 0.10 s *Note: This is not displayed on the simulation.
calculate the acceleration of skater 1 $\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$ $\vec{a} = \frac{-0.23 \text{ m/s}}{0.10 \text{ s}}$ $\vec{a} = -2.3 \text{ m/s}^2$	calculate the acceleration of skater 2 $\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$
mass of skater 1 = 60.0 kg	mass of skater 2 = _____
calculate the force applied to skater 1 $\vec{F} = m\vec{a}$ $\vec{F} = (60.0 \text{ kg})(-2.3 \text{ m/s}^2)$ $\vec{F} = -1.4 \times 10^2 \text{ N}$	calculate the force applied to skater 2 $\vec{F} = m\vec{a}$ * Round your answer to 2 significant digits.

- (1 marks) **LAB 2.** What do you notice about the magnitude of the force applied to each skater?

(1 marks) **LAB 3.** What do you notice about the direction of the force applied to each skater?

(2 marks) **LAB 4.** Restate Newton's third law using the force values you calculated for each skater.

(2 marks) **TR 2.** Two basketball players run into each other. Player 1, with a mass of 55.0 kg, experiences a -15.6 m/s^2 acceleration. If player 2 has a mass of 48.5 kg, what acceleration did she experience immediately following the collision?

(6 marks) **TR 3.** Complete the following table. The first row has been completed as an example.

Action	Action Force	Reaction Force
A bullet is fired from a gun by the expanding gases.	expanding gases pushing on the bullet	bullet pushing back on the expanding gases
A volleyball is served.	player's hands exerting a forward force on the ball	
The Moon orbits Earth.		moonward pull of the Moon acting on Earth
A firewoman opens the fire hose, and water sprays forward.		
A sprinter's shoe hits the ground.		

(3 marks) **TR 4.** Sketch a diagram to show how an action-reaction pair of forces could be used to move across a frictionless surface.

- (3 marks) TR 5.** Explain where the forces originate and how the child could minimize the time it takes to get off the frictionless sheet of ice.
- (3 marks) TR 6.** Compare and contrast the child's strategy for getting off the ice with the operating principles of a rocket engine. In your answer indicate what a rocket engine throws out that serves a similar purpose to the textbook used in the child's strategy.
- (5 marks) D 1.** Answer question 3 of "Analysis" on page 141 of the textbook. Post your solution to the airbag issue to the discussion area, and respond to postings from at least two other students. If you wish to change your answers before submitting them to your teacher, do so.

- (3 marks) D 2.** Answer question 4 of "Analysis" on page 141 of the textbook. Post your proposed changes to the airbag design to the discussion area, and respond to postings from at least two other students. If you wish to change your answers before submitting them to your teacher, do so.

MODULE 3: LESSON 3 ASSIGNMENT

This Module 3: Lesson 3 Assignment is worth 20 marks. The value of each assignment and each question is stated in the left margin.


(20 Marks) Lesson 3 Assignment: Normal Force and Friction

(1 marks) LAB 1. What is the maximum force applied before the books start to move?

(1 marks) LAB 2. What is the applied force required to keep the books moving?

(4 marks) LAB 3. Complete the following questions.

- a. What happens to the size of the static frictional force as you start to pull on the force scale?
- b. Is there a maximum size for the static frictional force? If so, what happens to the object if the applied force exceeds the maximum static frictional force?
- c. Is there a minimum size for the static frictional force? If so, under what conditions will this force be a minimum?
- d. What type of frictional force acts when the system is at rest?

- (3 marks) **LAB 4.** Using the applet, measure the applied force required to keep the books moving. Then complete the following table. To calculate the normal force, assume that each book has a mass of 1.00 kg. Use the  button to remove books, and use the "Reset" button to start over.

Number of Books	Normal Force (N) $F_N = mg$	Kinetic Frictional Force (N)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

- (3 marks) **LAB 5.** Complete Graph 1 by plotting the normal force on the x-axis (manipulated variable) and the kinetic frictional force on the y-axis (responding variable). Label the graph appropriately.

GRAPH 1: KINETIC FRICTIONAL FORCE VS. NORMAL FORCE



(2 marks) TR 4. The coefficient of static friction between a book and the level surface it slides on is 0.65. If the mass of the book is 2.0 kg, what minimum initial applied force is required to slide the books across the surface?

(2 marks) TR 5. An engine provides 5.0 kN of force to keep a 1600-kg vehicle moving at a uniform speed. (Air resistance is negligible.) What is the coefficient of rolling friction between the tires and the road surface?

(4 marks) Reflect and Connect

The amount of friction between train wheels and the track is based on the normal force and the coefficient of friction between the dry steel of the wheel and the dry steel of the track.


The coefficient of friction for steel on dry steel is 0.41 (static) and 0.38 (kinetic).

The GE Evolution series locomotive has a mass of 188 000 kg. Determine the amount of static and kinetic friction force available to the wheels. Is this force equivalent to the maximum braking force, the maximum useful engine force, or both?

MODULE 3: LESSON 4 ASSIGNMENT

This Module 3: Lesson 4 Assignment is worth 21 marks. The value of each assignment and each question is stated in the left margin.

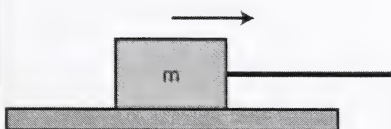
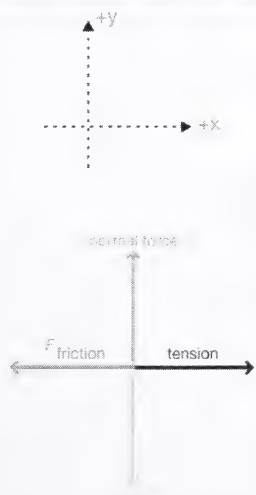
(21 Marks) Lesson 4 Assignment: Free-Body Diagrams and Net Force

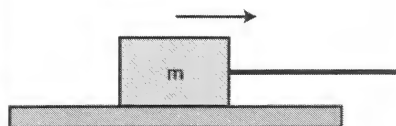
(11 Marks) TR 1. Select "project" from the drop-down menu titled "Projects" at the top of the applet. Load the images shown below using the "Image" button ( Image), and complete the table by doing the following:

- Identify and list all of the forces in the system.
- Draw a correctly labelled free-body diagram (FBD).
- On your FBD, draw a convenient coordinate system and assign vector directions.
- Derive the relevant net force equations for the FBD as shown above.

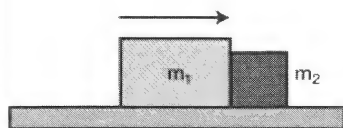
The first project is done for you as an example.

You may print out the FBD and coordinate axis for each project by right-clicking on the diagram and selecting Print. You will be shown a preview screen. Click on the printer icon at the bottom, and select your printer (or print to file if you are sending your answer electronically). Click OK.

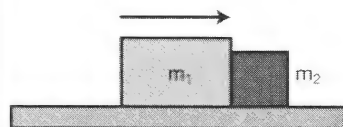
Project	List Forces	Draw FBD	Equations (m_1 and m_2)
 <p>A block is pulled to the right at a steady speed on a rough surface.</p>	normal force tension friction weight		$F_{\text{net}} = (+T) + (-F_f)$ $F_{\text{net}} = \text{zero}$ $ma = \text{zero}$



A block is pulled to the right and accelerating on a rough surface.




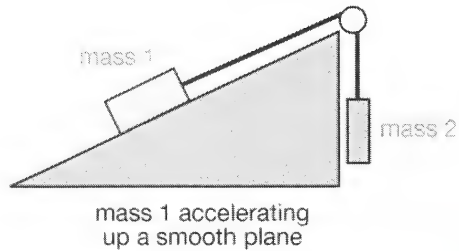
Two blocks in contact are pushed with a steady speed to the right on a rough surface.



Two blocks in contact are pushed to the right and accelerating on a rough surface.

(6 marks) TR 2. Solve question 5 of "3.1 Check and Reflect" on page 136 of your textbook.

(4 marks) TR 3. Load the image of the second incline, shown below, using the “Image” button ( Image).



Complete a project information table by doing the following:

- Identify and list all of the forces in the system. (Assume the “smooth plane” is a frictionless surface.)
- Draw correctly labelled free-body diagrams for both mass 1 and mass 2.

Add the relevant components of the weight ($\vec{F}_{g\parallel}$ and $\vec{F}_{g\perp}$).

- On your free-body diagrams, draw convenient coordinate systems and assign vector directions for the situation of both mass 1 and mass 2.
- Derive the relevant net force equations for the FBD for the situations along the slope (mass 1) and also the situation in the vertical direction (mass 2).

MODULE 3: LESSON 5 ASSIGNMENT

This Module 3: Lesson 5 Assignment is worth 34 marks. The value of each assignment and each question is stated in the left margin.

(34 Marks) Lesson 5 Assignment: Solving Net Force Problems

(2 marks) TR 1. A crate of bananas with a mass of 25.0 kg is dragged across a level floor by an applied force of +150 N [E] against a frictional force of 50.0 N [W]. What is the observed acceleration of the crate?

(3 marks) TR 2. A milk carton with a mass of 2.00 kg is pulled across a table with a horizontal force of 3.00 N. If the coefficient of friction is 0.110, what is the acceleration of the milk carton?

(4 marks) TR 3. A box of cereal is pushed with an applied force of 2.4 N [W] across a table. If the cereal box has a mass of 2.5 kg and the box accelerates at 0.41 m/s^2 [W], what is the force of friction? What is the coefficient of friction for the table top?

(3 marks) TR 4. A 5.0-kg toolbox is pulled west across a concrete floor with a rope. The rope makes an angle of 45.0° with the floor. A force of 85.0 N is exerted on the rope, and the force of friction is 15.0 N parallel to the floor. Calculate the acceleration of the box.

TR 5. TR 5. In "Example 3.16" on page 179 of your textbook and in the text titled "Example Problem 4: On an Incline" that you studied in the first part of this lesson, the $\vec{F}_{\text{net } \perp}$ did not enter into the calculations. However, the $\vec{F}_{\text{net } \perp}$ was part of the calculations in "Example 3.18" and "Example 3.20."

(2 marks)

a. Why was $\vec{F}_{\text{net } \perp}$ needed in the last two examples but not the first two?

(1 mark)

b. What formula was used to calculate $\vec{F}_{\text{net } \perp}$?

LAB 1. Equations (1) and (2) are the fundamental equations governing the motion of the system. Each of these equations can be used independently to determine the tension in the string.

(1 mark)

a. Using equation (1), calculate the tension in the string if $m_1 = 0.600 \text{ kg}$ and $a = 3.92 \text{ m/s}^2$. Show your work. Verify your answer using the applet.

(1 mark)

b. Using equation (2), calculate the tension in the string if $m_2 = 0.400 \text{ kg}$ and $a = 3.92 \text{ m/s}^2$. Show your work. Verify your answer using the applet. Your answer should be identical to LAB 1.a.

(2 marks) **LAB 2.** Given the following masses, calculate the acceleration of the system.

$$m_1 = 0.600 \text{ kg}$$

$$m_2 = 0.800 \text{ kg}$$

Verify your answer on the applet by adjusting the mass values to match those given. The mass values on the applet are controlled by the mass slider. Show your work.

(2 marks) **LAB 3.** Notice that the tension value of 2.35 N is *less* than the weight of block 2. The weight of block 2 is calculated by

$$W_2 = m_2g = (0.400 \text{ kg}) (9.81 \text{ m/s}^2) = 3.92 \text{ N}$$

What would the acceleration of the system be if the tension were equal to the weight of block 2? Explain your answer. (**Hint:** Study the free-body diagram of block 2 to answer this.)

LAB 4. Using the definitions above, complete the following calculations and explanations.

(1 mark) a. Calculate the weight of a 60.0-kg person on Earth's surface.

(2 marks) b. Suppose you jumped onto your bathroom scale. Would the scale initially indicate a high weight and then settle down to your actual weight? (**Note:** The initial weight would be your apparent weight at the moment you landed on the scale.)

(2 marks)

- c. Your apparent weight can be greater than your actual weight. Is this **true** or **false**? Explain.

LAB 5. The apparent weight of the passenger equals the magnitude of the normal force acting on the passenger. Use the terms *greater than*, *equal to*, or *less than* to compare the passenger's weight when the elevator is at rest to the apparent weight when the elevator

(1 mark)

- a. accelerates upward

(1 mark)

- b. coasts

(1 mark)

- c. slows down

LAB 6. Use the simulation for assistance in answering the following questions.

(1 mark)

- a. Calculate the apparent weight of an 80.0-kg person riding in an elevator that is accelerating upward at a rate of 5.00 m/s^2 .

(1 mark)

- b. Use a free-body diagram to explain what happens to the apparent weight of a person if the elevator begins to "free fall" (accelerating downward at 9.81 m/s^2).

(1 mark)

- c. You are in an elevator that is accelerating upward at 6.00 m/s^2 . If your apparent weight is 800 N, what is your mass?

(1 mark)

- d. A passenger on an elevator experiences an apparent weight of 500 N while accelerating downward. If the mass of the passenger is 70.0 kg, at what rate is the passenger accelerating?

(1 mark)

- e. While travelling down between floors at a constant speed, a passenger has a weight of 800 N. During the acceleration to stop the elevator, the passenger experiences an apparent weight of 1000 N. Calculate the acceleration of the elevator.

Once you have completed all of the questions, submit your work to your teacher.